

DESIGN, MODELING AND ANALYSIS OF HYBRID POWER GENERATION SYSTEM

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ABSTRACT

The project aims at developing a system which makes use of wind, piezo and solar energy for rural and urban electrification. This project cuts down the floor space used by conventional wind mills and solar panels. This configuration allows the three sources to supply the load depending on the availability of the energy sources. Energy is being generated from the three sources such as solar energy, wind energy and piezo electricity and in turn is being generated from the sun light, wind, and from the piezo electric sensors respectively. All three sources need to be placed in a single design and we had created that design by using software called Fusion 360.

KEYWORDS: Wind Turbines, Piezo Sensors & Arduino Uno

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INTRODUCTION

From the earlier days, our ancient people have been making use of the solar and wind energy but they didn't have a proper idea on how to make use of them. In spite of doing extensive research, it was a failure. But today's generation has made full usage of this solar energy and wind energy. By the end of this project, we will know how to save and generate power from the solar and wind and piezo sensors without creating any damage to the environment and also without causing any pollution. The wind energy that is generated will be stored in a battery and battery is connected to supply generator. It utilizes software called MOFSET, which is useful in performing ON/OFF pulses for the different frequencies.

CLASSIFICATION OF ENERGY SOURCES

The types of energy sources used in this project are:

- **Solar power Energy:** Solar energy is the most available free source of energy in this world. By using solar energy, we can save lot of money. By using it in summer season, we can extract a huge amount of peak output. For the extraction of solar energy, a solar panel is required and it helps converting the light energy into the electrical energy.
- **Wind Turbine Energy:** The most used energy after solar energy is wind turbine energy. The usage of this energy is that the wind mills on rotating will convert the kinetic energy present in the air into mechanical power and that power is converted into electricity by using a generator. Here, the usage of generator is very important because we will be converting the mechanical power into Electricity.

- Piezo electricity energy: This is the rarest type of energy that people are using till date. It has the ability that the materials used will generate the electrical energy in reaction to the applied mechanical stress. This sensor will make use of piezo electric effect and it will convert them to electrical charge.

LITERATURE GAP

The above survey led us to a conclusion where all the research papers have implemented only two of the energy sources for power generation. As per our design, we are harnessing power using solar wind and piezo sensors in a single unit unlike the others. Some of the above designs have the disadvantage of not utilizing most of the free energy available in nature. For instance, combination of solar and wind lead to wastage of mechanical vibrations available in the surroundings which can otherwise be harnessed by using piezo sensors.

COMPONENTS USED

Solar Panel

A solar panel is a device which is used to convert the light energy into the electrical energy. In this, the light energy that is extracted from the sun is converted into the electrical energy and power is produced. In this project, we will be using 25Watts solar panel and their dimensions are mentioned below.

Dimensions

- Length - 410mm.
- Breadth - 290mm.
- Thickness - 25mm.

The Solar Panel used can produce an output of 12w, considering the presence full sunlight.

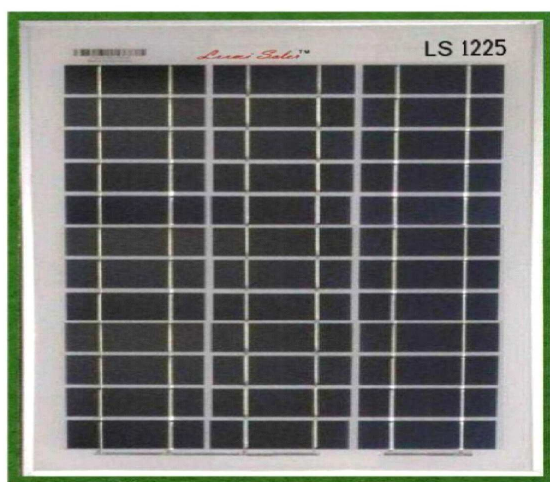


Figure 1: Solar Panel.

Wind Turbine

DC generator plays an important role in converting the K E into the electrical energy and the energy that is produced is stored in a battery.

Dimensions

- Length - 290mm
- Radius of the rotor - 90mm

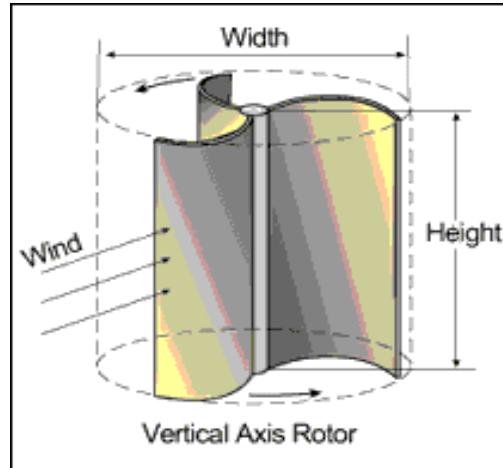


Figure 2: Vertical Axis Wind Turbine.

Piezoelectric Generator Principle

This piezo electricity generator works on the principle of generating the electricity from the mechanical stress that is produced by the vibration of the wind turbine. These sensors are the rarest forms of sources for generation power or energy respectively.

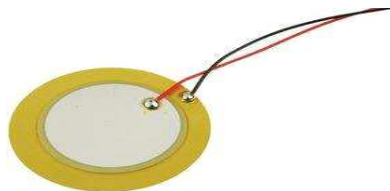


Figure 3: Piezo Electric Sensor.

COMPONENTS USED IN THE ELECTRIC CIRCUIT

Battery

The main objective and theme of the battery is nothing but when it gets charged, electrical energy is converted into the Chemical Energy. All the energy that is abstracted from the vertical axis wind mill is collected to this 12V battery and this has a switch of *configuration of ON and OFF buttons* respectively. This Battery plays an important role in this design and the battery used here is UB1213 12V battery and it is shown below.

Transformer

Generally, transformer is a device that will be converting the electrical energy from one circuit to another circuit. This transformer is mainly used in this design to increase or decrease the voltage respectively. There are two types of transformers one, step up transformer and the other one is step down transformer.

Booster Circuit

A booster circuit is a device that acts as a boost convertor that step up the voltage from its inputs to output.

Wifi Module

This wifi module is integrated in our design for the access of wifi-network. The chips that we are using in our pro to type are little bit low effective chips.

Arduino Uno

Arduino uno is the one that connects the devices with the help of USB cable. It is a micro controller. It has 14 digital outputs and also same number of inputs.

16×2 LCD

The output that is generated from the design is seen in this LCD display.

PROPOSED MODEL

Figure 4: Proposed Model.

The frame which is being used was first designed on a 3D modeling software called Fusion 360. The frame was designed in such a manner that the solar panel, vertical axis windmill and the DC generator would fit into it without obstructing to each other. The material used to construct the frame is mild steel. The main usage of the frame is to hold all the components and to act as the body of the prototype. Different components like the solar panel, vertical axis wind turbine, dc generator, electric circuit are fitted onto the frame.

WORKING

The main parts that are used in this design are Solar panel, Vertical Axis Wind Turbine, Piezoelectric Sensors, Battery of 12V, Booster circuit, Wi-fi module, Arduino Uno, LCD, Transformer, DC Generator. All energy that is obtained from the sunlight is stored in the solar panel and all energy from wind turbine is stored in the 12V battery and the energy is in the form of KE and later it is connected into the DC generator for converting that energy into the electrical energy. All piezo sensors we used in this project are less effective and hence output produced by the sensors is also very less effective. The above is the simple working description of "Hybrid Power Generation System".

CALCULATIONS

For the above model designed and fabricated, the following data is obtained.

Table 1

S. No	Velocity(mts/hr)	P_{max} (Watts)
1	4	1.261
2	6	4.259
3	9	14.37
4	10	19.72
5	12	34.076

For the above calculated data, the graph is plotted as shown below.

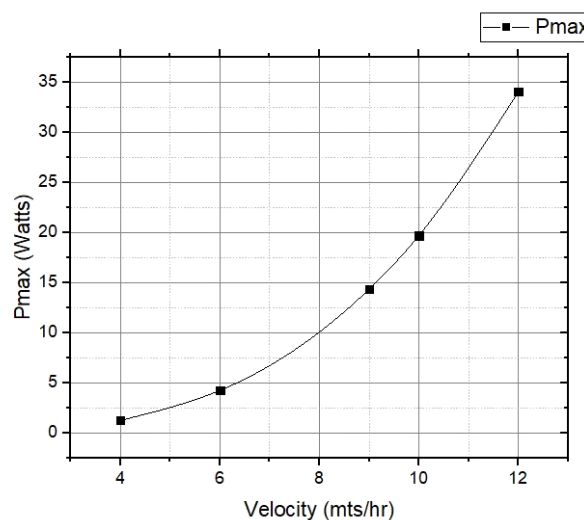


Figure 5

RESULTS

- With maximum sunlight, the 25-watt solar panel can produce 12 volts of power supply.
- The wind turbine in our project can produce 0-20 volts of power.

FUTURE SCOPE

These designs can be implemented in the shopping malls, railway stations, bus stations and public crowded places for maximum efficiency. This project will work only when there is sunlight and wind energy.

CONCLUSIONS

It is concluded hereby that the scarcity of energy sources is increasing day by day. Due to this reason, we have designed this project which will be useful for electrifying rural areas and urban areas.

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